

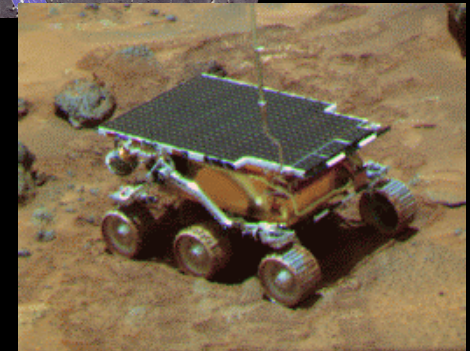
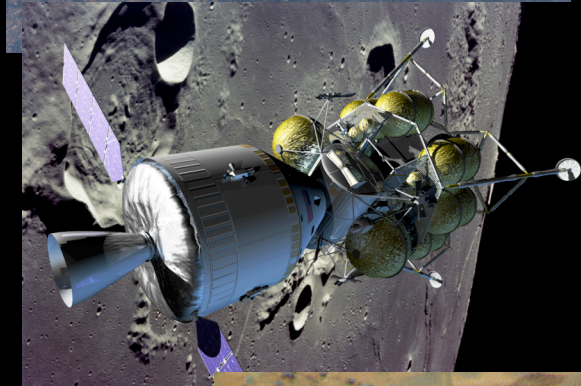
In the 21st Century

Thomas J. Horn
Chief, Aerostructures Branch
NASA Dryden Flight Research Center
Edwards, California

February 17, 2006

Vision for Space Exploration

- Announced by President Bush on January 14, 2004
- Sustained human and robotic exploration of the solar system
 - Complete the International Space Station
 - Safely fly the Space Shuttle until 2010
 - Develop and fly the Crew Exploration Vehicle no later than 2014 (goal of 2012)
 - Return to the Moon no later than 2020
 - Extend human presence across the solar system and beyond
 - Implement a sustained and affordable human and robotic program
 - Develop supporting innovative technologies, knowledge, and infrastructures
 - Promote international and commercial participation in exploration



NASA Mission Directorates

- Program divided into 4 missions:
 - Aeronautics
 - Enable a safer, more secure, efficient, and environmentally friendly air transportation system.
 - Science
 - Exploring the Earth-Sun system, our own solar system, and the universe beyond.
 - Space Operations
 - Extend the duration and boundaries of human space flight to create new opportunities for exploration and discovery.
 - Exploration Systems
 - Direct the identification, development, and validation of exploration systems and technologies.

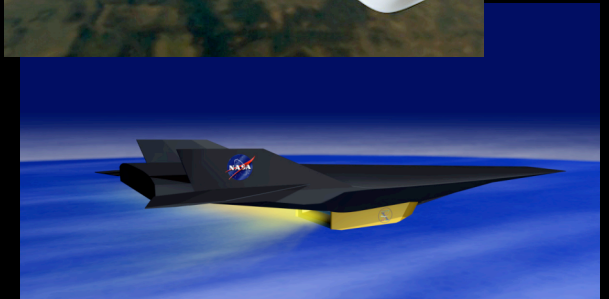
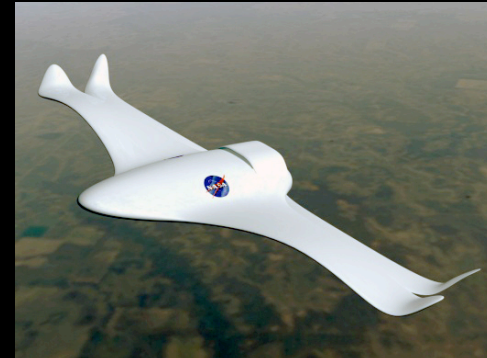


NASA Centers

- Ames Research Center
 - Mountain View, CA
 - Aerospace technologies
- Dryden Flight Research Center
 - Edwards, CA
 - Flight research and test
- Glenn Research Center
 - Cleveland, OH
 - Aeropropulsion and communication technologies
- Goddard Space Flight Center
 - Greenbelt, MD
 - Earth, solar system, and universe observations
- Jet Propulsion Laboratory
 - Pasadena, CA
 - Robotic space exploration
- Johnson Space Center
 - Houston, TX
 - Human space exploration
- Kennedy Space Center
 - East coast of Florida
 - Space launch prep & execution
- Langley Research Center
 - Hampton, VA
 - Aeronautics and space research
- Marshall Space Flight Center
 - Huntsville, AL
 - Space transportation and propulsion technologies
- Stennis Space Center
 - Southern Mississippi
 - Rocket propulsion testing and remote sensing technologies

Aeronautics Mission

- Currently in a replanning effort
- Three Principals:
 - We will dedicate ourselves to the mastery and intellectual stewardship of the core competencies of Aeronautics for the Nation in all flight regimes.
 - We will focus our research in areas that are appropriate to NASA's unique capabilities.
 - We will directly address the R&D needs of the Next Generation Air Transportation System (NGATS) in partnership with the member agencies of the Joint Planning and Development Office (JPDO).



Imagining the Future of Air Travel

- Imagine a world where:
 - Airlines don't burn fossil fuels
 - Aircraft could stay aloft for days, weeks, or months at a time to:
 - Monitor the environment
 - Enhance our security
 - Help us communicate
 - Flight delays caused by air traffic congestion are virtually unheard of
 - You can fly coast-to-coast in under 2 hours – without a sonic boom disturbing people on the ground
 - You can fly people or cargo between *any* two major cities in the world in under 2 hours

Aeronautics Programs

- Three major Aeronautics technology programs
 - Fundamental Aeronautics
 - Subsonic Fixed and Rotary Wing projects
 - Supersonics project
 - Hypersonics project
 - Aviation Safety
 - Integrated Vehicle Health Management project
 - Integrated Intelligent Flight Deck project
 - Integrated Resilient Aircraft Control project
 - Aircraft Aging and Durability project
 - Airspace Systems
 - Airspace project
 - Airportal project
- Focused on making what we can imagine today the reality of tomorrow



National Aeronautics and Space Administration

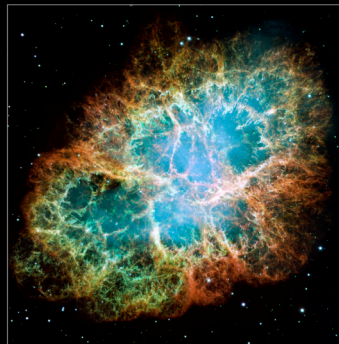
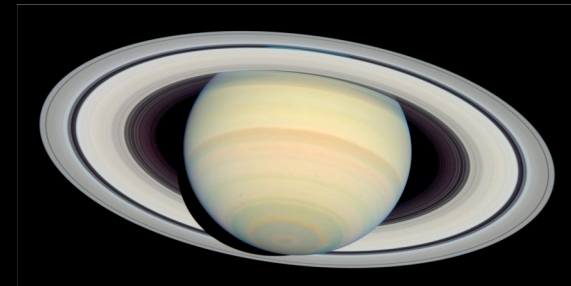
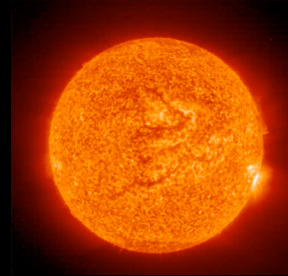
The Future is Closer Than You Think!

Play “Aeronautics” video here

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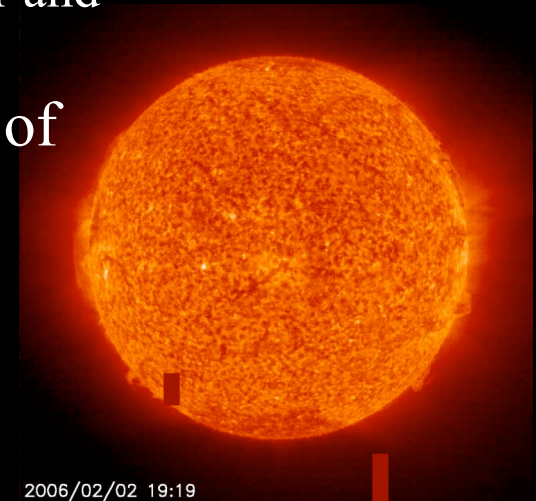
Science Mission

- Responsible for broad range of NASA scientific research
- 3 mission areas
 - Earth-Sun System
 - Solar System
 - Universe



Earth-Sun System Science

- Utilizes ground based, airborne, and space based instruments to study
 - Factors influencing climate change
 - Impact of the Sun on Earth
 - Human impacts
 - Utilize data to understand and predict weather and the environment here on Earth
- Responsible for development and launch of U.S. weather satellites
 - POES
 - GOES



Solar System Science

- Current activity
 - Mercury (MESSENGER, 2011)
 - Mars (5 missions)
 - Saturn (Cassini)
 - Pluto (New Horizons, 2015)
 - Comets (Deep Impact, 2004; Rosetta, 2014)
 - Edge of the Solar System (Voyager)
- Future missions
 - 3 Mars missions
 - 1 robotic Lunar mission
 - 1 mission to asteroids Vesta and Ceres



Universe Science

- Exploring the depths of the universe through earth based and space based assets
 - 15 active missions
 - 14 are space based
 - 14 missions in work
 - 12 are space based
- Over 100 planets discovered
 - At least 1 planet with an atmosphere
- Most famous project: Hubble Space Telescope



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15 Years of Hubble

Play “Revelations” video here

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Space Operations

- Space Shuttle
- Space Station
- Launch Services
 - Expendable vehicles
- Space Communications
 - TDRS
 - Ground based



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Space Shuttle

- First flight in April, 1981
- Scheduled for retirement in about 2010
- Primary mission today is Space Station assembly and re-supply
 - May perform 1 more Hubble servicing mission
- Up to 7 crew, up to 56,000 lb of cargo



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The Loss of Columbia

- Shaping NASA in the 21st century
- Technical cause: tank foam causing hole in lead edge heat shield
- Organizational causes: There were many
 - Lessons:
 - Success in past doesn't ensure success in future
 - Give technical staff an alternative route to voice concerns
 - Communicate! Communicate! Communicate!



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Return to Flight Efforts

- STS-114 first RTF mission July 2005
- STS-121 tentative launch summer 2006
- Both missions testing safety improvements since Columbia
 - Minimizing ET foam loss
 - Orbiter thermal protection (TPS) repair
 - Gather data on orbiter TPS damage



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Recovering a Shuttle at Edwards, CA

Play “Shuttle movie” video here

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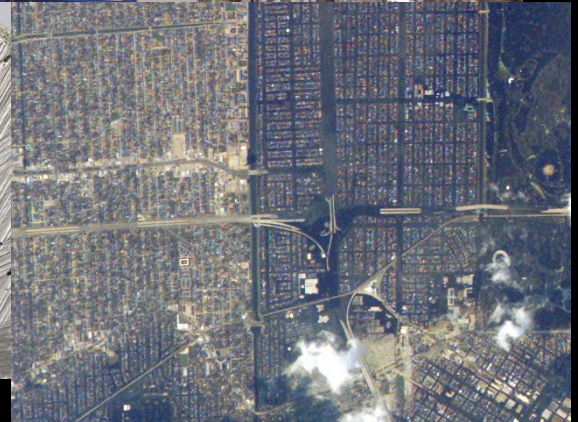
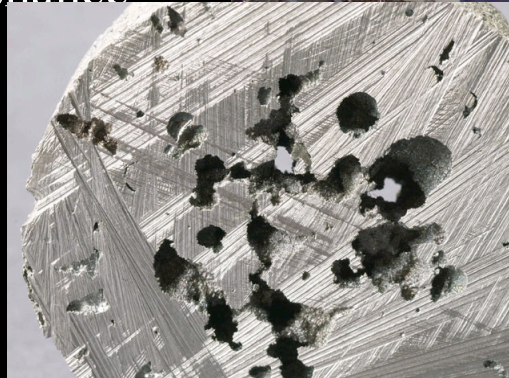
International Space Station

- First component launched in 1998
- Continuous occupancy since November, 2000
- It's BIG! (and still growing)
 - 240 ft x 146 ft x 90 ft
 - >400,000 lb
 - 15,000 cu ft habitable volume



Work Onboard

- US research focused on exploration vision
 - Effects on crew
 - Assembly of large structures
 - Operation and maintenance
 - Telemedicine
- Other science
 - Materials
 - Earth observation
 - Medical
 - Education



Exploration Systems

*“We leave as we came, and God willing, as we shall return,
with peace and hope for all mankind.”*

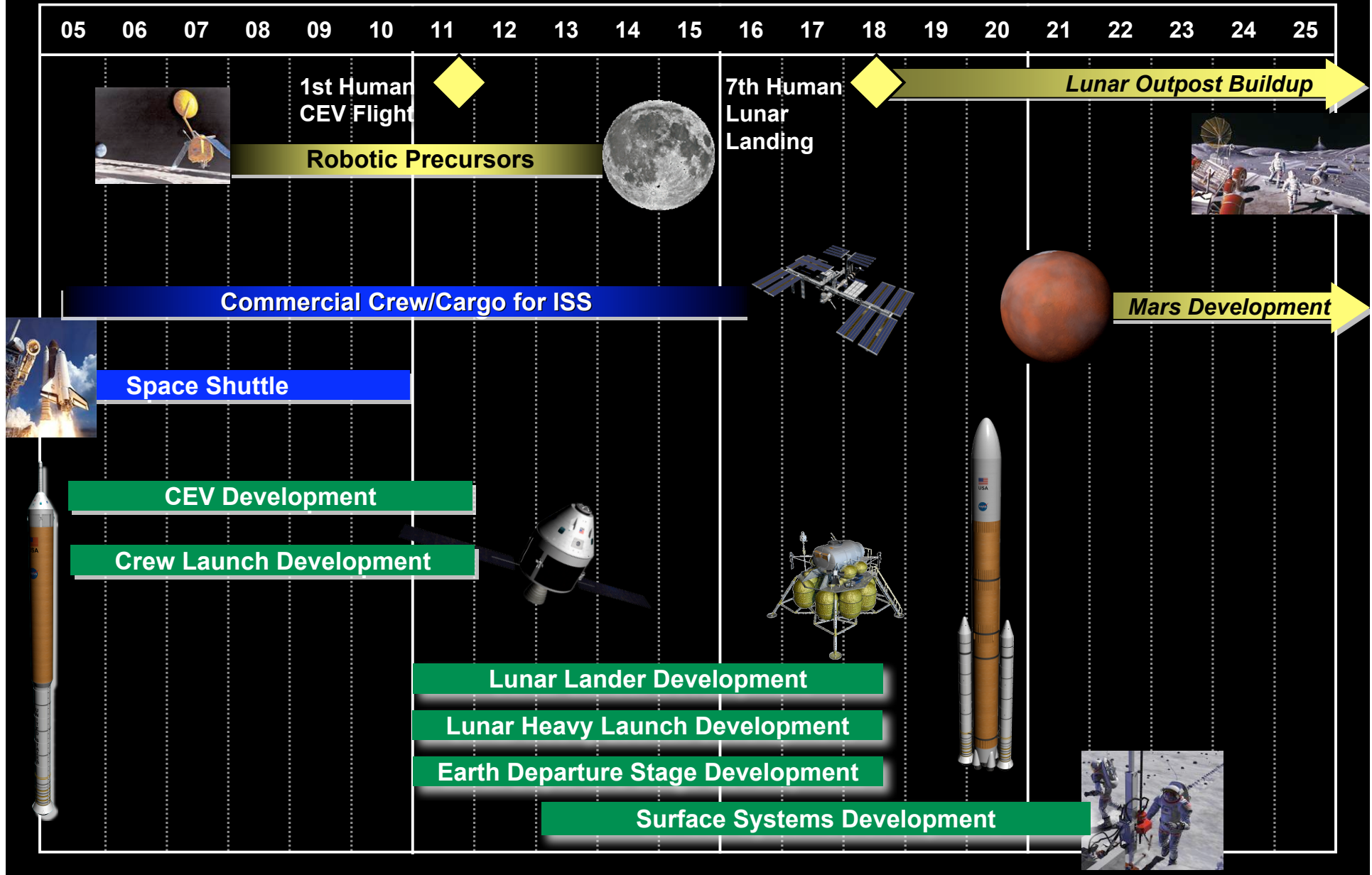
— Eugene Cernan, Commander of
the last Apollo mission



*The United States must lead the expansion of the space
frontier to continue to maintain our world leadership
role, and for the security of the nation.*

*Great nations do great and ambitious things. We must
continue to be great.*

The Exploration Roadmap



The Moon - the 1st Step to Mars and Beyond....

- Gaining significant experience in operating away from Earth's environment
 - Space will no longer be a destination visited briefly and tentatively
 - “Living off the land”
 - Human support systems
- Developing technologies needed for opening the space frontier
 - Crew and cargo launch vehicles (125 metric ton class)
 - Earth ascent/entry system – Crew Exploration Vehicle
 - Mars ascent and descent propulsion systems (liquid oxygen / liquid methane)
- Conduct fundamental science
 - Astronomy, physics, astrobiology, historical geology, exobiology

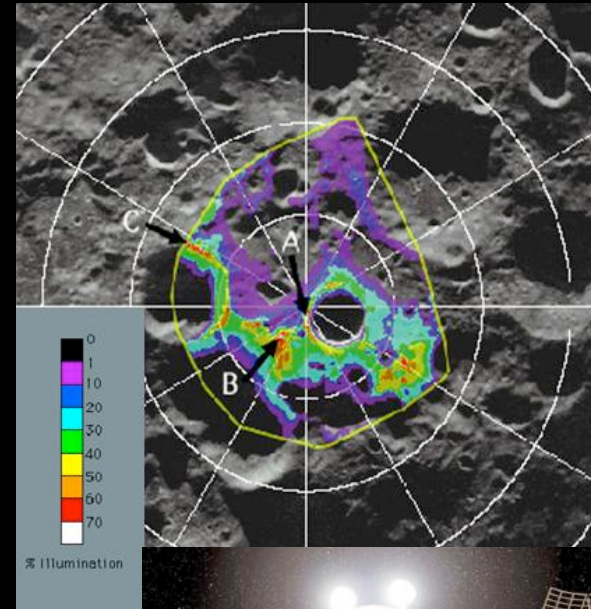


Next Step in Fulfilling Our Destiny As Explorers

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Possible South Pole Outpost

- The lunar South Pole is a likely candidate for outpost site
- Elevated quantities of hydrogen, possibly water ice (e.g., Shackleton Crater)
- Several areas with greater than 80% sunlight and less extreme temperatures
- Incremental deployment of outpost – one mission at a time
 - Power system
 - Communications/navigation
 - Rovers
 - Habitat and laboratory modules



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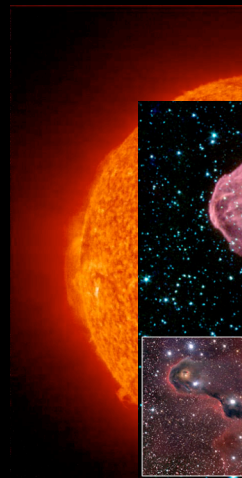
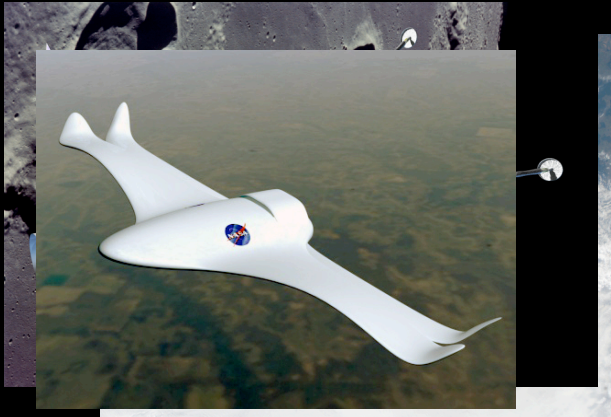
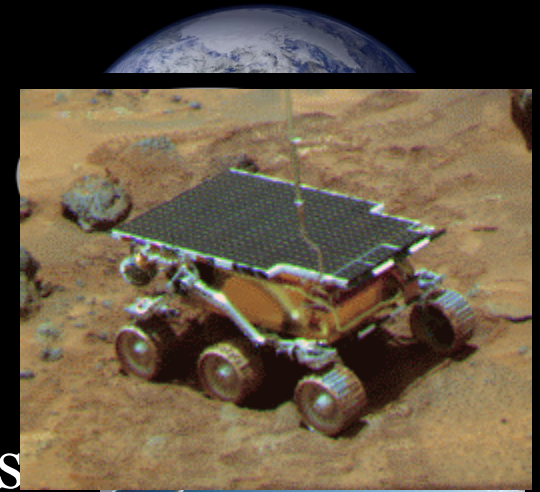
Crew Exploration Vehicle Concept

Play “ESMD movie” video here

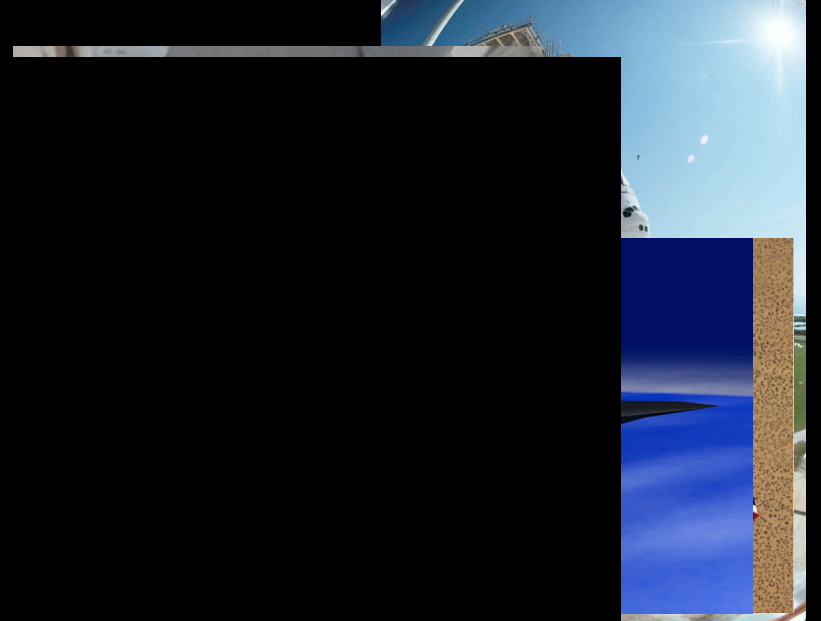
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Conclusion

- More information:
 - www.nasa.gov
- NASA Centers offer tours
 - Call ahead for times and reservations
- Thank You!



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